Study of Brucellosis in communal and smallholder areas in South Africa

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Prevalence, herd health and zoonotic implication of Brucellosis in communal and smallholder farming areas in South Africa

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EXECUTIVE SUMMARY

Introduction

Brucellosis is a disease of both economic and public health importance in many geographical regions of the world (Ducrotoy et al., 2014). The disease is caused by a bacterium from genus *Brucella*, a gram negative coccobacilli, which is non-spore forming, non-motile, aerobic bacteria, although some species might need 10% CO2 to grow (Alton et al., 1996; Bayemi et al., 2009). The genus Brucella currently contains seven commonly known species: *Brucella melitensis (B. melitensis), Brucella abortus (B. abortus), Brucella canis (B. canis), Brucella ovis (B. ovis), Brucella suis (B. suis), Brucella pinnipedialis (B. pinnipedialis)* and *Brucella neotomae (B. neotomae)*, which vary in their ability to infect host animals (Prefer et al., 2017). The classification of Brucella species is purely based on host specificity and pathogenicity of the species (Godfroid, 2002). Species differentiation is made by urease production, cell wall antigens dye and phage sensitivity (Alton et al., 1996; Scholz & Vergnaud, 2013). Brucella produce generalised infections with a bacteraemic phase followed by localisation in the

reproductive organs and reticuloendothelial system. Infection in the pregnant animal will cause foetal and placental infection that will often lead to abortion (Alton & Forsyth, 1996).

Brucellosis caused by B. abortus and B. melitensis are one of the major causes of abortion, birth of weak offspring, stillbirth, retained placenta and infertility in cows, does and ewes (Godfroid, 2002; Hesterberg et al., 2008). Given that, abortions at any stage of pregnancy may cause many setbacks to any livestock production management system, thus Brucella infections may result in significant economic losses to the livestock industry due to abortions and slaughtering of infected animals (Hesterberg et al., 2008; Gomo et al., 2011). *B. ovis* is also an important cause of orchitis and epididymitis in sheep although it is not recognised as a cause of natural infection in goats (Jarikre et al., 2015). Wild animals are also susceptible to infection and pose substantial risk to public health as game industry is rapidly expanding encroaching areas close to farm animals and human settlement (Godfroid, 2002).

Brucellosis is endemic in Sub-Saharan African countries, including South Africa and the prevalence rates vary according to agro-ecological region (Yasmin & Lone, 2015). The epidemiology of brucellosis is complex, but the prevalence and incidence of the brucellosis is influenced by management factors, herd sizes, population density, type of animal breed (beef or dairy) and health status of the herd (Addis, 2015).

Brucellosis is recognised as the most important bacterial zoonosis worldwide and there can be over 500 000 new human infections every year (Addis, 2015; Azam, et al., 2016). This disease is responsible for a considerable economic and health-related burden in humans, livestock and wildlife (Addis, 2015). Humans are accidental hosts who are mainly infected through the consumption of contaminated dairy products or by direct contact with infected animals as well as exposure to infected excretions of cattle, foetuses, foetal membranes or with infected carcase materials in abattoirs (Khan, Han & Memish, 2001). As there is close relationship between animals and their owners in rural settings, a fertile ground for zoonotic diseases transmissions is created (Swai & Schoonman, 2010). Cultural habits such as the consumption of fresh or soured milk may more or less contribute to the risk of acquiring such disease (Yasmin & Lone, 2015).

Reports suggested that brucellosis has long been present in South Africa, and the first documented cases of *B. melitensis* in South Africa was in sheep in the former Transvaal province in 1965 (now known as Gauteng, Limpopo, Mpumalanga and the eastern parts of North West province) (Wojno et al., 2016). Brucellosis is a notifiable disease in South Africa according to the Animal Disease Act 35 of 1984 and all suspected and confirmed cases of abortions should be reported to the nearest State Veterinary office for zoo-sanitary actions as prescribed in the national Brucellosis control scheme. Currently three known vaccines, namely strain 19 and RB 51 in bovine, as well as Rev 1 in sheep and goats, are used to control the disease. These vaccines are attenuated vaccines with potential to be pathogenic to humans if administrated directly or indirectly (Hendricks et al., 1995; Lalsiamthara & Lee, 2017).

Limited information is available on the persistence and prevalence of brucellosis in rural communities practicing communal livestock management systems in South Africa (Hesterberg et al., 2008). The disease burden is not only a threat to the social economic development (agriculture/tourism) but as well as to animal health, biodiversity and to human health, due to the zoonotic nature of this pathogen. Moreover, it is believed that communal communities are economically and culturally dependent on livestock and there is always an

unavoidable close and frequent contact between man and animals (Godfroid, 2002; Muendo et al., 2012). It is also a concern that through consumption of contaminated milk and meat, both livestock owners and the wider community might be at a high risk of acquiring brucellosis.

Animal brucellosis control strategies differ from country to country. In developed countries eradication and avoiding re-introduction of brucellosis is the best control measurement (Hesterberg et al., 2008). Where as in less developed and developing countries, monitoring and control of brucellosis is very uneven and often reports may not accurately reflect the existing disease scenario in the population (Hesterberg et al., 2008). In other African countries, control of Bovine brucellosis is commonly practiced in the Southern African countries such as Botswana, Namibia, South Africa, Zimbabwe and Lesotho (McDermott & Arimi, 2002). Botswana started its control measures in the year 1996 and by the year 2000, had reported decline in bovine brucellosis cases (McDermott & Arimi, 2002). It is thus critical to determine the prevalence and associated risk factors to understand the degree and severity of the problem and to suggest possible intervention strategies (Muendo et al., 2012). There are no adequate records on the status of brucellosis in livestock in the communal and emerging production systems in South African provinces such as Limpopo, North West and Eastern Cape.

Objective Statements

The goal of this project was, therefore, to produce comprehensive data on the prevalence, distribution, risk factors and zoonotic implications of brucellosis in Limpopo, North West and Eastern Cape provinces.

Project Aims

- To determine the prevalence, herd health and zoonotic implications of brucellosis in cattle in study areas of South Africa
- To determine the risk factors and sources of brucellosis in cattle populations in study areas
- To understand the zoonotic implications and human health risks in the study areas

Results

In LP, 1167 samples including sera, n=1034; milk, n=17 & organs, n=16 collected from 3 district municipalities (see details report) were tested. Of the 47 RBT pos samples, only 3 tested CFT pos and 6 were suspects. All the pos and suspect animals originated from Mopani District and the 3 pos were from Mariveni village. The apparent prevalence was estimated to be 0.87% including the suspects. 1 cows was a mixed breed (6 years old, given birth 3 times), another was from Nguni breed (age unknown, Heifer cow) and the last pos sample was collected from a 2 years' age old Nguni cow that had not yet given birth. From Lefera village, 2 suspect pos animals were detected, unfortunately the animals' information was not available. In Mogapong village, 4 suspect were detected, collected from a 4-year-old Nguni cow as well as from three Nguni cows of unknown ages. Of these 4 suspects, 2 had given birth twice and 4 times respectively, 1 cow had not yet given birth, and no birth information history was provided for the remaining cow. None of the milk samples tested were pos using MRT. 16 tissue samples were collected from 5 bulls slaughtered in 2 rural abattoirs. DNA was extracted directly from 14 of these using Qiagen extraction kit. DNA was subjected to a 16S rRNA gene PCR analysis specific for brucella spp. PCR amplifications were obtained in samples from 4 of

the 5 bulls. PCR amplicons were subjected to DNA sequencing for further analysis using ABI sequencer. Additionally, individual AMOS PCR including RB51 and S19 vaccine strains was conducted, however, all yielded neg results. Sequence alignment and phylogenetic analysis suggested we detected Brucella spp or *Ochrobactrium anthropi*- a sequence included in the analysis as out group. All samples were cultured on BTA & Farrell media. No brucella spp. isolation was made, probably because the cells were already dead, or there were just few viable and culturable cells. From the E. C, 599 sera collected from the dip tanks in Chris Hani district were analysed. Only 3 sera were pos following the RBT testing and antibodies to *B. abortus* were confirmed in 2 samples by CFT. One of the cows was 3 years old, of mixed breed and had not yet calved, while the other cow was a mixed breed, 7 years of age and had calved 3 times. The apparent sero-prevalence was therefore estimated to be 0.33%. Additional sera (n=218) were collected from abattoirs in the Amathole and Chris Hani districts. Milk samples (n=98) were also collected form one of the dairy farms in the Amathole district. Of the 218 sera tested by RBT, antibodies were detected in 14, and confirmation was made in 13 sera and animals originated from Amathole. All pos samples were collected from cows of cross breed. The prevalence was therefore calculated to be 6% at abattoirs. No antibodies to B. abortus were detected in all milk samples analyzed. In the NW, 4 districts municipalities were selected (see full report). 495 sera from the dip tanks (n=200) and abattoirs (n=295) and 7 milk samples were collected. Overall, 18 sera tested pos for brucella antibodies. Confirmation was made in 15 of the 18 samples. 10 of the confirmed pos samples were collected from cattle in eight dip tanks and 2 abattoirs in the Ngaka Modiri Molema district. The remaining 5 pos samples were collected from one village (n=1) and 1 abattoir (n=4) in the Dr Ruth Mompati district. The prevalence in this province was 3%. No milk samples were pos for Brucella antibodies.

Feedback was obtained from 74 participants in LP, 33 in the N. W and 5 from the E.C. In general, majority of the participants were livestock owners, they were mostly unemployed and were not well educated. They kept mixed breeds, which they obtained from the local markets (>90%) as opposed to breeding their own animals to increase the herd. Only few of the participants had recent incidents of abortion in their herds (8.3% in NW and 5.7% in LP). When asked how they would handle the aborted material should there be an incident, most participants in NW (86%) stated that they would handle the material with their bare hands, contrary to only 3% in LP, and would bury such material before washing their hands with soap and water. Only a few of the participants indicated that they would feed the material to their household pets. Participants were mostly aware of Brucellosis (55% in NW and 93% in LP) and had basic understanding of how to handle animals that are suspected to have the disease. Although they had basic understanding of the disease, only a few knew that people could become infected (<9% in all provinces). Some farmers in the NW (33%) indicated that they do vaccinate their animals, and only 37.5% of those who vaccinate knew which vaccines are used. Those that did not vaccinate their animals indicated varying reasons for not vaccinating as opposed to lack of finances. However, in general, 75% of the participants in this province knew that vaccines were available as opposed to 26% in LP.

Conclusion

Reports suggested that brucellosis has long been present in South Africa. Brucellosis is a notifiable disease in the country according to the Animal Disease Act 35 of 1984 and all suspected and confirmed cases of abortions should be reported to the nearest State Veterinary office.

Overall, the apparent sero-prevalence of brucellosis in communal and rural cattle was found to be 0.87% in LP and 3% in N.W. In the E. cape, prevalence was 0.33% for farmed cattle, and 6% at abattoirs respectively. Animals slaughtered at abattoirs originate from different areas as abattoirs are used for passive and active surveillance of diseases hence, the prevalence obtained in the E. Cape abattoirs is not surprising. Majority of cattle sampled in this study were cows. No specific association could be made with regard to the association of the disease risk with variables such as age, breed and number of calving. A previous study has reported an overall seropositivity of 17.65% in LP over a 9-yr period, with less than 10% and 5% in N.W & E. Cape provinces respectively. Very recently (November, 2020), an outbreak of brucellosis was reported in the northern part of KZN province. Although the source of infection is currently unknown, this outbreak further suggests that brucellosis prevalence maybe higher in many regions of the country. The questionnaire survey revealed that most participants were not aware that brucellosis can affect humans and that aborted material should not be handled with bare hands, hence these factors were associated with an increased risk of brucellosis transmission among cattle handlers. Cattle owners obtained their stock stocks from the local markets, thereby presenting a risk of introducing the disease into their own cattle herds. Overall, no specific cattle breed was associated with the risk of brucellosis infection. Our findings suggest that more still need to be done in terms of data generation and public awareness if brucellosis is to be eradicated.

Popular Article

Title for Popular Article

Brucellosis in Limpopo, North West and the Eastern Cape provinces of South Africa

1 January 2021

Introduction

Brucellosis is a disease of both economic and public health importance in many geographical regions of the world. Reports suggest that the disease has long been present in South Africa. Brucellosis is a notifiable disease in the country according to the Animal Disease Act 35 of 1984 and all suspected and confirmed cases of abortions should be reported to the nearest State Veterinary office.

The missing link and an attempt to fill the knowledge gap

There are no adequate records on the status of brucellosis in livestock in the communal and emerging production systems in South African provinces such as Limpopo, North West and Eastern Cape. We have conducted a research project with a view to produce a comprehensive data on the sero-prevalence, risk factors and zoonotic implications of brucellosis in these provinces.

Overall, the apparent sero-prevalence of brucellosis in communal and rural cattle was found to be 0.87% in Limpopo and 3% in the North West province. In the Eastern Cape province, the apparent sero-prevalence was 0.33% for farmed cattle, and 6% at abattoirs respectively. Majority of cattle sampled in this study were cows. No specific association of disease risk could be made with variables such as age, breed and number of calving. A previous study has reported an overall sero-positivity of 17.65% in Limpopo province over a 9-year period, with less than 10% and 5% in North West and Eastern Cape provinces respectively. Very recently

(November 2020), an outbreak of brucellosis was reported in the northern part of KwaZulu-Natal province. Although the source of infection is currently unknown, this outbreak further suggests that brucellosis prevalence maybe higher in many regions of the country than suspected. The questionnaire survey revealed that most participants in this study were not aware that brucellosis can affect humans and that aborted material should not be handled with bare hands, hence these factors were associated with an increased risk of brucellosis transmission from cattle to cattle handlers. Cattle owners obtained their stock stocks from the local markets, thereby presenting a risk of introducing the disease into their own cattle herds. Overall, no specific cattle breed was associated with the risk of brucellosis infection.

Conclusion

Our findings suggest that more still needs to be done in terms of data generation and public awareness if brucellosis is to be eradicated.

Figure 1 A herd of cattle inside collection crushes in preparation for sample collection
Figure 2 Ms Karabelo Madiba, an MSc student, with one of the project participants of the questionnaire survey

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